

PRODUCT DISPOSITION AND SUPPLY CHAIN SUSTAINABILITY OF BOTTLED WATER COMPANIES IN RIVERS STATE

WAGBARA Happiness ALEX-AKEKUE Nennaaton POI Elizabeth Ledisi
Department of Marketing, Faculty of Administration and Management
Rivers State University Nkpolu-Oroworukwo, Port Harcourt

Abstract

This study examined the correlation between product disposition and supply chain sustainability of bottled water companies in Rivers State, focusing on how product disposition relates to economic, environmental, and social sustainability. Founded on the Natural Resource-Based View, the study adopted a correlational research design with a cross-sectional approach. The population of the study comprised 10 registered and functional bottled water companies operating in Rivers State. The entire population was studied. 36 respondents provided data for the study through a semi-structured questionnaire designed in Likert 5-point scale. The Pearson Product Moment Correlation statistic was used to test the correlation between product disposition and measures of supply chain sustainability. The results showed that product disposition relates positively and significantly to economic, social and environmental sustainability. Thus the study concluded that there is a significant relationship between product disposition and supply chain sustainability of bottled water companies in Rivers State; and recommends that bottled water companies that seek to improve their supply chain sustainability should invest in closed-loop recycling systems that enable collection, cleaning, and reuse of bottles; prioritizing eco-design when developing new packaging; and engage consumers in sustainability initiatives.

Keywords: economic sustainability, environment sustainability, product disposition, social sustainability supply chain sustainability

Introduction

The bottled water industry in Nigeria has seen rapid growth in recent years, driven by increased urbanization, rising consumer demand, and the growing need for clean drinking water. This expansion, however, has led to significant environmental concerns, particularly in relation to the sustainability of the supply chain and the disposal of packaging materials. Product disposition - the process of managing products after their useful life has become a critical factor in assessing the environmental footprint of industries, especially in developing economies like Nigeria. For bottled water companies, this refers primarily to the disposal and recycling of plastic bottles, which form a substantial part of the waste generated. Given the rapid expansion of the bottled water market in Nigeria, the sustainability of supply chains, including efficient waste management practices, plays an essential role in minimizing negative environmental impacts.

The growing consumption of bottled water in Nigeria, has placed significant pressure on waste management systems, particularly in urban areas, where plastic waste is a common environmental issue. While some companies have made strides in implementing recycling and sustainability initiatives, many still struggle with inefficient waste disposal and lack of robust recycling infrastructure (Ogunwande & Oduyemi, 2021). Furthermore, issues such as inadequate policies, low public awareness, and limited technological capacity hinder the successful management of product disposition in the industry (Ajayi et al., 2020). Consequently, addressing these challenges requires a closer examination of the relationship between product disposition practices and the broader sustainability goals within the supply chain.

This study examined how product disposition affects sustainability of supply chains in the bottled water sector and evaluated strategies adopted by companies in Nigeria to enhance their waste management practices. By understanding the intricate relationship between product disposition

and sustainability, this study sought to provide recommendations for improving waste management in the Nigerian bottled water industry and fostering a more sustainable future.

Theoretical Framework

This study took its bearing from Natural Resource-Based View (NRBV) which extends the resource-based view (RBV) framework to focus on the relationship between a firm's resources and its environmental practices, emphasizing the strategic role of natural resources in shaping business outcomes (Hart, 1995). NRBV is particularly relevant for industries that rely heavily on natural resources, such as the bottled water industry, where sustainability concerns related to resource use, waste, and environmental impact are increasingly prominent.

NRBV provides a useful lens through which to explore how firms integrate environmental considerations into their supply chain operations. By adopting a sustainability-focused approach, firms can create value not only for shareholders but also for the environment and society (Hart, 1995). This view underscores the importance of firms leveraging their internal resources, such as technological capabilities, human capital, and organizational culture, to develop sustainable practices that reduce environmental harm. For instance, companies that adopt efficient waste management systems or engage in water conservation practices are utilizing these resources to foster long-term sustainability, which can serve as a competitive advantage in a market that is becoming more environmentally conscious.

The justification for underpinning this study by NRBV lies in the increasing pressure on companies to align their business strategies with sustainability goals. As the bottled water sector in Nigeria faces growing environmental challenges, understanding how firms use their resources to mitigate negative environmental impacts is crucial. Furthermore, the NRBV highlights the potential for companies to gain competitive advantages through strategic environmental management, which is essential for driving sustainability in the supply chain (Russo & Fouts, 1997). This perspective is particularly relevant for this study as it emphasizes the importance of resource management in the pursuit of supply chain sustainability.

Concept of Product Disposition

Product disposition refers to the management of products at the end of their life cycle, encompassing reuse, recycling, disposal, and recovery (Rogers & Tibben-Lembke, 1999). Product reuse refers to the practice of using a product again in its original form for a similar or different function. Reuse reduces the demand for new resources, extending the product's lifecycle and minimizing waste. For instance, secondhand products or refurbished electronics contribute to reduced resource consumption and landfill waste (Lacy & Rutqvist, 2015).

Recycling involves converting waste materials into new products, thus recovering valuable raw materials. This process helps conserve resources and reduces the environmental footprint of manufacturing new products. For example, recycling metals or plastics ensures that raw materials are not continuously extracted from the environment (Gupta & Jain, 2020). Disposal refers to the final handling of products or materials that cannot be reused or recycled. Though often seen as the least desirable option, disposal via landfills or incineration may be necessary for certain items. However, improper disposal can result in significant environmental harm, particularly with hazardous materials (Rathnayake et al., 2022).

Recovery refers to the extraction of useful materials or energy from waste products. This can include energy recovery from waste incineration or recovering valuable materials from e-waste. Recovery reduces the need for virgin resources and contributes to a circular economy (Lacy &

Rutqvist, 2015). Together, these practices contribute to a more sustainable approach to product end-of-life management, aligning with global efforts to reduce waste, conserve resources, and mitigate environmental impacts.

Product disposition is an essential aspect of sustainable supply chain management, particularly for industries that generate significant waste, such as the bottled water sector. In the context of bottled water companies, product disposition focuses primarily on the disposal and recycling of plastic bottles, which have become a major environmental concern globally due to their long decomposition times and potential for contributing to plastic pollution (Lebreton et al., 2017). Efficient product disposition strategies are crucial for minimizing the environmental footprint of bottled water products, particularly in regions like Nigeria, where waste management infrastructure is often underdeveloped (Ogunwande & Oduyemi, 2021).

Effective product disposition can help mitigate the negative environmental impacts of plastic waste through processes like recycling and reusing materials, reducing the need for new raw materials, and lowering greenhouse gas emissions. For example, recycling plastic bottles can prevent waste from accumulating in landfills and contribute to the conservation of natural resources (Kumar & Putnam, 2018). However, achieving these benefits requires the development of efficient collection and recycling systems, public awareness, and regulatory frameworks that incentivize sustainable practices (Ajayi et al., 2020).

In many developing countries, including Nigeria, the challenge of product disposition is compounded by inadequate recycling infrastructure and insufficient governmental support (Ogunwande & Oduyemi, 2021). As a result, bottled water companies often face difficulties in managing their waste responsibly. The implementation of circular economy principles—where materials are continuously reused or recycled—can provide an effective solution to these challenges, enabling companies to adopt more sustainable product disposition practices (Kirchherr et al., 2018).

Supply Chain Sustainability

Supply chain sustainability refers to the integration of environmental, social, and economic factors into the operations of a supply chain to ensure its long-term viability while minimizing negative impacts on society and the environment (Seuring & Müller, 2008). This concept has gained significant importance in recent years as businesses face increasing pressure from consumers, governments, and stakeholders to adopt sustainable practices throughout their supply chains. Sustainable supply chain management (SSCM) involves the design, production, and distribution of goods in a manner that reduces resource consumption, enhances efficiency, and contributes to societal well-being (Carter & Rogers, 2008).

For companies, incorporating sustainability into the supply chain not only helps mitigate risks related to environmental damage and resource scarcity but also creates long-term value and competitive advantages. Practices such as reducing waste, improving energy efficiency, sourcing ethically, and ensuring fair labor conditions are essential to achieving a sustainable supply chain (Sarkis, 2012). In industries like bottled water, sustainability can be realized through initiatives like using eco-friendly packaging, optimizing transportation to reduce carbon footprints, and implementing water conservation strategies in production (Gualandris et al., 2015).

Supply chain sustainability also extends to the management of product life cycles, including aspects like product design, packaging, and disposal. For instance, bottled water companies are increasingly investing in alternative packaging materials, such as biodegradable or recyclable

bottles, to minimize the environmental impact of plastic waste (Chardine-Baumann & Botta-Genoulaz, 2005). Furthermore, ensuring that the supply chain supports equitable labor practices and engages with communities in a socially responsible way adds another dimension to sustainability efforts (Pagell & Wu, 2009).

In the context of Nigeria, where waste management and environmental awareness are still evolving, adopting sustainability practices in the bottled water industry is crucial. By embracing sustainable practices, companies can improve their reputation, reduce operational costs, and contribute positively to environmental conservation, thus ensuring a more sustainable future for both the industry and society at large. Therefore, we adopt economic sustainability, social sustainability and environmental sustainability as indices of supply chain sustainability.

Economic sustainability

Economic sustainability refers to the ability of a system, organization, or country to maintain long-term economic health without compromising the ability of future generations to meet their needs (Daly, 1990). It involves practices that foster the efficient use of resources, ensure long-term profitability, and support economic development while minimizing negative social and environmental impacts. Unlike traditional economic growth models, which often prioritize short-term profits, economic sustainability focuses on creating value over the long run by balancing economic, environmental, and social factors (Barbier, 2011).

In business, economic sustainability involves strategies that ensure a company remains financially viable over time while operating within the planet's ecological limits. For example, businesses can improve their economic sustainability by investing in renewable energy, reducing waste, enhancing supply chain efficiencies, and supporting local communities (Sarkis, 2012). By implementing these practices, businesses not only reduce costs but also create new revenue streams through green products and services. Furthermore, businesses that adopt sustainable practices often build stronger relationships with consumers and other stakeholders who increasingly prioritize sustainability (Schaltegger & Wagner, 2011).

In developing countries like Nigeria, economic sustainability faces unique challenges. Issues like poverty, unemployment, and limited access to resources make it difficult for businesses to adopt sustainable practices. However, fostering economic sustainability in these regions is crucial for long-term development. For instance, the bottled water industry in Nigeria, which relies on plastic packaging, can reduce costs and improve sustainability by investing in recycling infrastructure, exploring alternative packaging materials, and promoting environmentally responsible consumption among consumers (Ogunwande & Oduyemi, 2021).

Economic sustainability also involves reducing risks associated with market volatility, resource depletion, and environmental degradation. By adopting strategies that enhance resource efficiency and promote sustainable practices, businesses can better withstand economic challenges, thus ensuring their survival and success in the long term (Hart, 1995). Overall, economic sustainability requires businesses to consider not only the financial bottom line but also their environmental and social impacts, creating a holistic approach to long-term prosperity.

Social sustainability

Social sustainability refers to the ability of a society or community to maintain and improve the well-being of its members over time. It focuses on fostering social equity, community development, and the protection of human rights, ensuring that all individuals have access to essential resources, opportunities, and a healthy environment (Boström, 2012). In a business

context, social sustainability involves practices that contribute to the welfare of employees, customers, and broader communities, including ethical labor practices, promoting diversity and inclusion, and ensuring that products or services do not harm the social fabric of society (Elkington, 1997).

A key aspect of social sustainability is creating fair and just working conditions. Businesses that prioritize fair wages, safe working environments, and opportunities for employee development contribute to the overall well-being of their workforce (Bocken et al., 2014). For example, companies in industries such as bottled water manufacturing can enhance social sustainability by ensuring that their suppliers and partners follow ethical labor practices, providing workers with fair wages and safe working conditions (Harrison & Freeman, 2015). Additionally, promoting diversity and inclusion within the workplace fosters a more collaborative and innovative environment, leading to improved productivity and employee satisfaction (Shore et al., 2011).

Social sustainability also extends to the community level, where businesses can play a vital role in addressing social issues such as poverty, education, and healthcare. Corporate social responsibility (CSR) initiatives often focus on investing in local communities by supporting social programs, providing educational opportunities, or contributing to public health campaigns (Carroll, 1999). In countries like Nigeria, where social inequalities are prevalent, businesses that focus on social sustainability can help address some of these challenges by contributing to local development and supporting underserved communities (Ogunwande & Oduyemi, 2021).

Social sustainability emphasizes the need for businesses to consider the social impacts of their operations and contribute positively to society. By focusing on fair labor practices, community well-being, and social equity, companies can enhance their long-term viability and create a more sustainable and inclusive society.

Environmental sustainability

Environmental sustainability refers to practices that meet the needs of the present without compromising the ability of future generations to meet their own needs, particularly concerning the natural environment (Brundtland, 1987). It involves the responsible use and conservation of natural resources, as well as the mitigation of negative environmental impacts resulting from human activities, including pollution, deforestation, and climate change. Environmental sustainability is crucial for ensuring the long-term health of ecosystems and the planet, and businesses play an essential role in achieving these goals through sustainable practices within their supply chains, production, and product design (Hart, 1995).

In the context of industries such as bottled water, environmental sustainability focuses heavily on reducing waste, conserving water, and minimizing plastic pollution. One of the main concerns in the bottled water industry is the environmental impact of plastic packaging, which contributes significantly to global plastic waste (Jambeck et al., 2015). Many bottled water companies have responded by adopting sustainable packaging solutions, such as biodegradable materials or increasing the use of recycled plastic, to reduce the environmental footprint of their products (Schroeder et al., 2018). Moreover, improving the efficiency of production processes, such as reducing water and energy consumption, is another critical aspect of environmental sustainability in this industry (KPMG, 2020).

A significant challenge for businesses seeking to enhance environmental sustainability is the need for better waste management and recycling infrastructure. In developing countries like Nigeria, where waste management systems are often inadequate, plastic pollution has become a critical

issue (Ogunwande & Oduyemi, 2021). As the demand for bottled water continues to rise, it is essential for companies to invest in both environmental and technological solutions to mitigate these negative impacts. Collaborative efforts with governments, non-governmental organizations, and local communities can help address the broader challenges associated with waste disposal and recycling (Lebreton et al., 2017).

Environmental sustainability is a critical pillar of corporate responsibility. By implementing eco-friendly practices and adopting circular economy principles, businesses, including those in the bottled water sector, can contribute significantly to reducing environmental harm and promoting a more sustainable future for the planet.

Product Disposition and Supply Chain Sustainability

Kumar and Putnam (2008) investigated reverse logistics strategies and opportunities across three industry sectors in the United States. The purpose of the study was to explore reverse logistics practices, including product disposition, and their environmental benefits in various industries, including bottling. The study found that effective product disposition through recycling reduced waste by 40% in bottled water companies, lowered carbon emissions, and improved material recovery. Hence, it was concluded that product disposition significantly contributes to supply chain sustainability by fostering circular material flows.

Daddi et al. (2020) examined circular economy and sustainability as well as the role of green innovation in Italy. The purpose of the study was to assess the impact of circular economy practices, including product disposition, on environmental sustainability in bottled water companies. The study revealed that green innovation in product disposition improved recycling rates by 30% and significantly reduced landfill contributions.

Shi et al. (2012) examined natural resource-based green supply chain management in the UK. The purpose of the study was to examine how resource-efficient practices, including product disposition, drive supply chain sustainability in manufacturing and bottling. The study reported that bottled water companies that prioritized recycling and reuse achieved a 25% reduction in raw material usage and improved customer perceptions of sustainability.

Jabbour and de Sousa Jabbour (2014) investigated the relationship between green supply chain practices and environmental performance in Brazil. The purpose of the study was to evaluate the role of green supply chain practices, including product disposition, in enhancing environmental sustainability in bottling and other industries. The study showed that proper product disposition reduced bottling waste by 35% and contributed to improved compliance with environmental regulations.

Based on the foregoing review, the following hypotheses were formulated:

- H₀₁:** There is no significant correlation between product disposition and economic sustainability of bottled water companies in Rivers State.
- H₀₂:** There is no significant correlation between product disposition and social sustainability of bottled water companies in Rivers State.
- H₀₃:** There is no significant correlation between product disposition and environmental sustainability of bottled water companies in Rivers State.

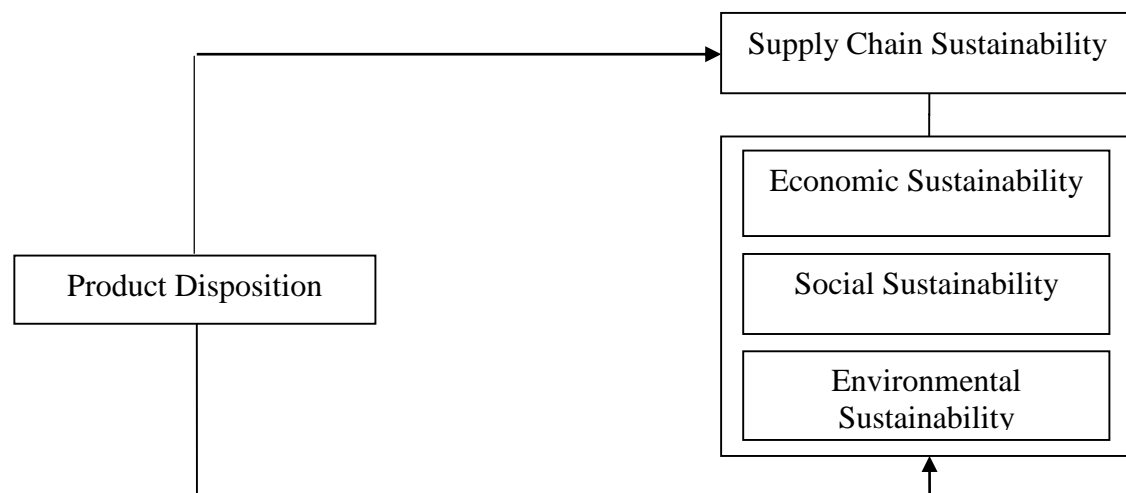


Fig. 1: Conceptual framework showing relationship between product disposition and supply chain sustainability of bottled water companies in Nigeria.

Source: Adapted from Rogers and Tibben-Lembke (1999).

Methodology

This study adopted correlational research design with a cross-sectional approach to establish the relationship between product disposition and supply chain sustainability of bottled water company in Rivers State. The population of the study comprised 10 registered and functional bottled water companies operating in Rivers State, in 2025. All the companies were studied because the population is small. However, 36 respondents comprising health, safety, and environment (HSE) officers (ii) operations managers (iii) waste management officers and (iv) logistics managers provided data for the study through a semi-structured questionnaire consisting of 16 measurement items. The instrument was designed in Likert 5–point scale.

Again, to determine the reliability of the research instrument, a pilot study (pretest) was conducted and the data were subjected to Cronbach's Alpha reliability test, subject to a threshold of 0.70 set by Nunally (1978). Furthermore, the construct validity of the instrument was determined through Exploratory Factor Analysis (EFA). See table 1 for results of reliability and validity tests. To determine the correlation between product disposition and measures of supply chain sustainability, Pearson Product Moment Correlation statistic was used to test 3 hypotheses at 0.05 level of significance. The analysis was done with the aid of Statistical Package for Social Sciences (SPSS) version 25.

Table 1: Results of Reliability and Validity Tests

S/N	Variables	Number of Items	Cronbach's Alpha Coefficients	Factor Loadings
1	Product Disposition	4	0.721	0.415
2	Economic Sustainability	4	0.881	0.916
3	Social Sustainability	4	0.918	0.877
4	Environmental Sustainability	4	0.739	0.833

Source: SPSS Output 2025.

Results of the Cronbach's alpha analysis in Table 1 revealed that all the variables in the study produced high Cronbach's Alpha coefficients. This is an evidence to show that, there is inter-item consistency among the variables in the study. In other words, if this study is conducted again in a similar condition the results will be similar to the results of this study. Again, all the variables have high factor loadings greater than 0.4, indicating that the items and variables in the

questionnaire measured what they were supposed to measure. These loadings indicated that there is no cross-loading hence there is discriminant validity.

Test of Hypothesis and Interpretation

Table 2: Correlation between product disposition and economic sustainability

		Product Disposition	Economic Sustainability
Product Disposition	Pearson Correlation	1	.456*
	Sig. (2-tailed)		.000
	N	36	36
Economic Sustainability	Pearson Correlation	.456*	1
	Sig. (2-tailed)	.000	
	N	36	36

*. Correlation is significant at the 0.05 level (2-tailed).

Source: SPSS Output 2025.

The analysis in Table 2 reveals that, product disposition has a moderate, positive and significant relationship with economic sustainability of bottled water companies in Rivers State. This result is evident in the correlation coefficients of 0.456 and probability value of $0.000 < 0.05$. In view of this result, the researchers rejects the hypothesis that *'there is no significant relationship between product disposition and economic sustainability of bottled water companies in Rivers State.*

Table 3: Correlation between product disposition and social sustainability

		Product Disposition	Social Sustainability
Product Disposition	Pearson Correlation	1	.308
	Sig. (2-tailed)		.038
	N	36	36
Social Sustainability	Pearson Correlation	.308	1
	Sig. (2-tailed)	.038	
	N	36	36

*. Correlation is significant at the 0.05 level (2-tailed).

Source: SPSS Output 2025.

Table 3 reveals that, product disposition has a weak, positive and significant relationship with social sustainability of bottled water companies in Rivers State. This result is evident in the correlation coefficients of 0.308 and a probability value of $0.038 < 0.05$. In view of this result, the researchers reject the hypothesis that *'there is no significant relationship between product disposition and social sustainability of bottled water companies in Rivers State.*

Table 4: Correlation between product disposition and environmental sustainability

		Product Disposition	Environmental Sustainability
Product Disposition	Pearson Correlation	1	.804*
	Sig. (2-tailed)		.015
	N	36	36
Environmental Sustainability	Pearson Correlation	.804*	1
	Sig. (2-tailed)	.015	
	N	36	36

*. Correlation is significant at the 0.05 level (2-tailed).

Source: SPSS Output 2025.

Table 4 shows that product disposition has a very strong, positive and significant relationship with environmental sustainability of bottled water companies in Rivers State. This result is evident in the correlation coefficients of 0.804 and a probability value of $0.000 < 0.05$. Based on this result, the researchers reject the hypothesis that *'there is no significant relationship between product disposition and environmental sustainability of bottled water companies in Rivers State.'*

Discussion of Findings

The study examined the correlation between product disposition and supply chain sustainability of bottled water companies in River state. The result of the statistical tests conduct in the study showed a moderate, positive and significant correlation between product disposition and economic sustainability of bottled water companies in Rivers State; a weak positive and significant correlation between product disposition and social sustainability; and a very strong, positive and significant correlation between product disposition and environmental sustainability of bottled water companies in Rivers State.

These findings are in line with findings of previous studies. For instance, the findings agree with the finding of Kumar and Putnam (2008) that effective product disposition through recycling reduced waste by 40% in bottled water companies, lowered carbon emissions, and improved material recovery. Similarly, our findings align with the findings of Daddi et al. (2020) that green innovation in product disposition improved recycling rates by 30% and significantly reduced landfill contributions.

Our findings are also support the results of Shi et al. (2012) that bottled water companies that prioritized recycling and reuse achieved a 25% reduction in raw material usage and improved customer perceptions of sustainability; and that proper product disposition reduced bottling waste by 35% and contributed to improved compliance with environmental regulations. These empirical studies demonstrate how product disposition in the bottled water industry can improve environmental sustainability by reducing waste and enhancing resource recovery through reverse logistics (Jabbour & de Sousa, 2014).

Conclusion

Based on the findings, we conclude that there is a positive and significant correlation between product disposition and supply chain sustainability of bottled water companies in Rivers State. By effectively managing the end-of-life phase of products, such as bottles and packaging materials, bottled water companies can significantly reduce the waste sent to landfills, thereby contributing to waste diversion efforts and minimizing their environmental footprint.

The recycling process, facilitated by robust product disposition systems, not only reduces the amount of waste generated but also conserves valuable resources. Bottled water companies that adopt recycling practices, such as using recycled PET (rPET) in new products, decrease their reliance on virgin materials, conserving natural resources and lowering the environmental costs associated with raw material extraction.

Additionally, product disposition enables companies to extend the life cycle of their packaging materials. Reuse and refurbishment, especially through systems like bottle refilling and closed-loop supply chains, reduce the need for new materials and lower the carbon emissions associated with production processes. This results in a more sustainable approach to product life cycles, where materials are continuously repurposed rather than disposed of.

By reducing waste, promoting recycling, and extending the life cycle of packaging materials, bottled water companies not only contribute to environmental preservation but also benefit from operational efficiencies, regulatory compliance, and enhanced brand reputation. These practices ultimately align with broader sustainability goals, helping the industry transition towards a more sustainable future.

Recommendations

Based on the findings and the conclusion reached, the study recommends that bottled water companies in Rivers State that seek enhanced supply chain sustainability should invest in closed-loop recycling systems that enable the collection, cleaning, and reuse of bottles. This can involve setting up dedicated return programs for consumers to return bottles for refilling or recycling. Closed-loop systems reduce the need for new raw materials, minimize waste, and extend the lifecycle of packaging, which supports a circular economy approach and improves sustainability.

The study also recommends that bottled water companies should prioritize eco-design when developing new packaging. This includes using lighter materials, making packaging more durable, and designing it to be easily recyclable. Eco-design helps reduce resource consumption, lowers production costs, and ensures that packaging materials can be efficiently reused or recycled, which contributes to reducing the environmental impact.

In addition, the study recommends bottled water companies should establish partnerships with local recycling facilities, waste management companies, and NGOs to ensure proper product disposition and maximize recycling rates. Collaboration can improve the efficiency of recycling systems, ensure better sorting and processing of materials, and enhance the recovery of valuable resources from used packaging.

More so, the study recommends that bottled water companies should engage consumers in sustainability initiatives by educating them about the importance of recycling and encouraging them to return bottles or participate in recycling programs. Educating and incentivizing consumers to return bottles or use recycling bins can significantly improve recycling rates and contribute to reducing waste.

Further, the study recommends that bottled water companies should implement robust monitoring systems to track and report on their product disposition practices, including waste reduction, recycling rates, and the use of recycled materials in production. Monitoring and reporting sustainability metrics allows companies to evaluate the effectiveness of their practices, identify areas for improvement, and provide transparency to stakeholders about their environmental impact.

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